Impact of workload on preparations quality in chemotherapy: a pilot simulation study

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Background
Chemotherapy preparation units have to manage an increase of activity with constant staff. Safety is therefore threatened.

Purpose
Measure the effect of a workload increase on preparations accuracy and error.

Material and methods
A simulation study using tracers (lidocaine and phenylephrine) was conducted in an operational context.

Study
3 randomised blocks of 1, 2 or 3 series of 6 randomised preparations at different dosages and volumes, starting from 2 concentrations of stock solutions were compounded.

Block A
1x8 syringes=8:
- 4 x phenylephrine
- 4 x lidocaïne
Fixed time of 1h

Block B
2x8 syringes=16:
- 8 x phenylephrine
- 8 x lidocaïne
Fixed time of 1h

Block C
3x8 syringes=24:
- 12 x phenylephrine
- 12 x lidocaïne
Fixed time of 1h

Analysis
Qualitative criteria
Visual observations
- wrong stock solution
- wrong diluent
- labelling error

Quantitative criteria
Validated CE methods
- accurate (<5% deviation)
- weakly accurate (5-10%)
- inaccurate (10-30%)
- error (>30%)

Results
Time of preparation:
A gradual reduction of the preparation time, inversely correlated with the workload, was observed. The average time for a preparation was 4min11s, 3min07s and 2min35s for sessions with 8, 16 and 24 syringes, respectively (p <0.0001).

Accuracy:
The accuracy of the syringes concentrations measured by quantitative analysis was not different between the three levels (p=0.23, mixed-effect Cox model regression).

Error:
The error rate (qualitative and quantitative analysis) increased with the number of preparations made in 1 hour: 1.1%, 2.1% and 4.5% for 8, 16 and 24 syringes, respectively. The difference of errors rate between the 3 levels was not statistically significant (mixed-effects logistic regression, p=0.15), possibly due to a lack of power.

Conclusion
Our pilot study shows that operators are able to increase their working speed without impacting doses accuracy. However, the acceleration of manual production rate appears to be possibly associated with a greater probability of making a mistake. Although this trend has to be confirmed in a larger sample size study (a multicenter study is ongoing), it encourages to avoid work overload and to take actions to smooth the activity over the day.